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NOTE BY THE EDITORS.—Strictly speaking the problem as worded is more general than the theorem proved by J. L. Walsh, as it includes surfaces which are cut by a plane in more than one circle; for example, a combination of several spheres. Neither W. D. Cairns nor J. L. Walsh has solved this more general problem. Indeed there might be some further difficulty in its interpretation. For we interpret circle as including the case of a single point, and any intersection of two figures might be regarded as consisting of point circles. We might exclude such circles, but we would not want to exclude the case of a plane tangent to a sphere.

ELIJAH SWIFT gave, in effect, the same discussion as J. L. Walsh above.

2814 [1920, 134]. Proposed by NATHAN ALTSHILLER-COURT, University of Oklahoma.

The bisectors of the angles formed by the diagonals of an inscribed quadrilateral are: (1) parallel to the lines joining the midpoints of the arcs subtended by the opposite sides of the quadrilateral on its circumcircle; (2) parallel to the bisectors of the angles formed by any pair of opposite sides of the quadrilateral; (3) equally inclined to pairs of sides of the quadrilateral.

SOLUTION BY J. W. CLAWSON, Ursinus College.

Let $L_1L_2L_3L_4$ be the inscribed quadrangle. L_2L_1, L_3L_4 intersect at N'; L_1L_3, L_2L_4 at N''. D_{12}, D_{34} are the midpoints of arcs L_1L_2, L_3L_4, respectively. Let the bisector of $L_3N''L_4$ cut the circle at X; let $D_{12}D_{34}$ cut L_1L_3 at Y; let the internal and external bisectors of $L_1N'L_4$ cut L_1L_3 in W, V.

Now

$$L_3N''X = \tfrac{1}{2}L_3N''L_4 = \tfrac{1}{2}(L_3L_1L_4 + L_1L_4L_2).$$

Also

$$L_3YD_{34} = L_3D_{12}D_{34} + L_1L_3D_{12} = \tfrac{1}{2}(L_3L_1L_4 + L_1L_3L_2).$$

Again

$$L_3VN' = \frac{\pi}{2} - N'WV = \frac{\pi}{2} - \frac{1}{2}L_1N'L_3 - L_4L_3L_1 = \frac{\pi}{2} - L_4L_3L_1 - \frac{1}{2}(L_2L_1L_3 - L_4L_3L_1)$$
$$= \frac{\pi}{2} - \frac{1}{2}(L_4L_3L_1 + L_2L_1L_3).$$

But

$$L_4L_3L_1 + L_1L_3L_2 + L_2L_1L_3 + L_3L_1L_4 = \pi.$$

Hence,

$$L_3VN' = \tfrac{1}{2}(L_1L_3L_2 + L_3L_1L_4).$$

Therefore, $D_{12}D_{34}$, $N''X$, and VN' are all parallel.

Similarly, the other facts may be established.

Note. (1) was proved by Neuberg, *Mathesis*, volume 6, (1906), page 14. I believe that (2) was first published in an article of mine "The Complete Quadrilateral," *Annals of Mathematics*, volume 20 (1919), page 257. There are several other lines belonging to an inscribed quadrangle which are parallel to the bisectors of the angles between its diagonals. An account of these will be found in the paper referred to.

Also solved by F. V. MORLEY, H. L. OLSON, A. V. RICHARDSON, and ARTHUR PELLETIER.

2843 (1920, 326). Proposed by E. H. MOORE, University of Chicago.

Show that the maximum of the absolute value of $2(a + ib)(x + iy) + i(a + ib)(z + iw) + i(c + id)(x + iy)$, where $i = \sqrt{-1}$, and a, b, c, d, x, y, z, w are real numbers for which $a^2 + b^2 + c^2 + d^2 = x^2 + y^2 + z^2 + w^2 = 1$, is $1 + \sqrt{2}$. Study the locus of the point-pairs, $P = (a, b, c, d)$, $Q = (x, y, z, w)$ of the unit-sphere in real four-space for which this absolute value assumes its maximum value.